Oct. 21, 1947. J. S. MONTGOMERY ET AL 2,429,424

POWER TONG

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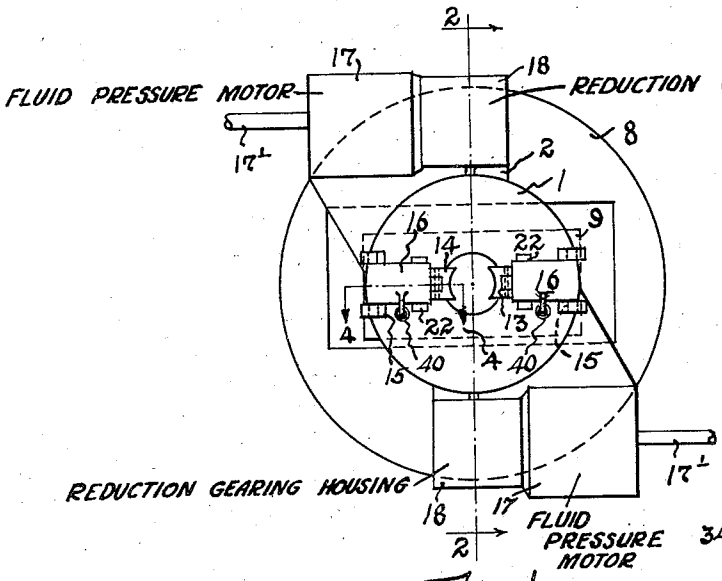


Fig. 1.

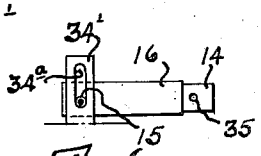


Fig. 6.

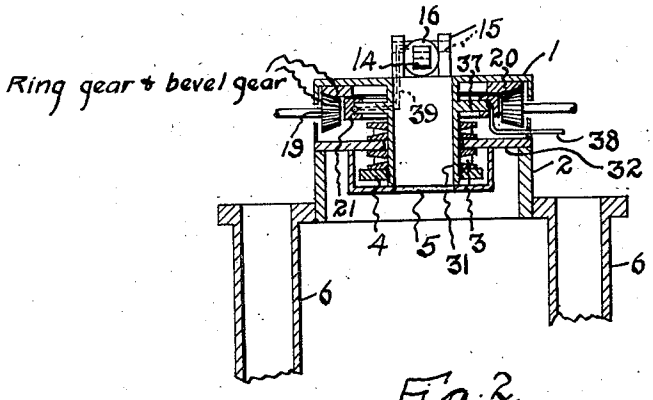


Fig. 2.

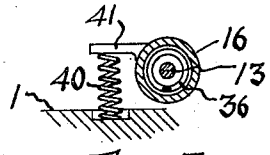


Fig. 5.

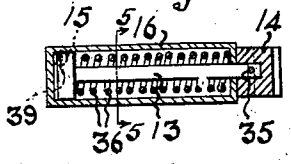


Fig. 4.

INVENTOR.
Jesse S. Montgomery
BY Harold S. Kelly
Darby & Darby
Att'ys.

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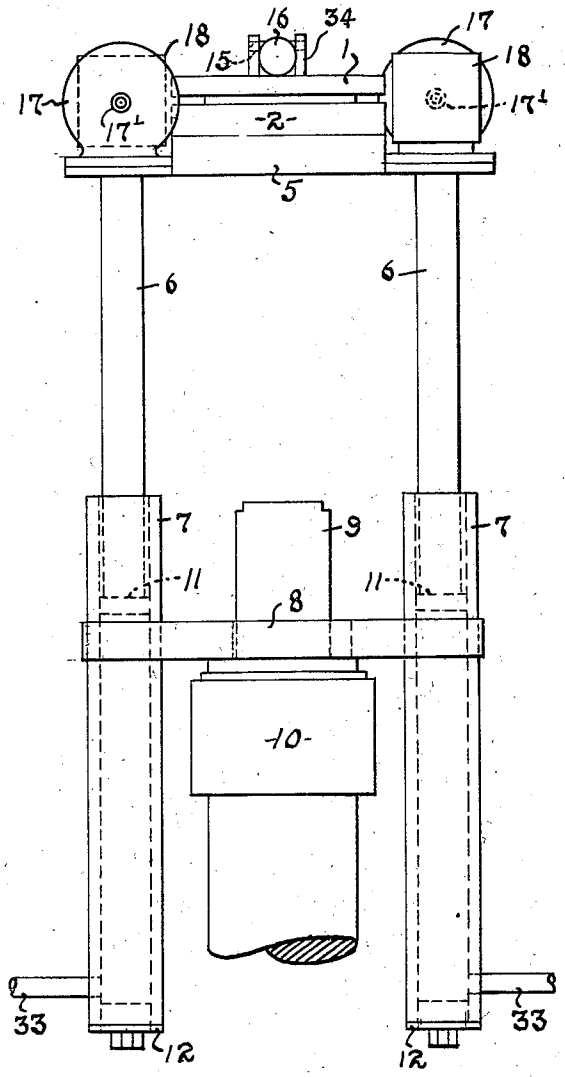


Fig. 3.

INVENTOR.
Jesse S. Montgomery
Harold S. Kelly.

BY Darby & Darby
Atty's.

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UNITED STATES PATENT OFFICE

2,429,424

POWER TONG

Jesse S. Montgomery and Harold S. Kelly, Oklahoma City, Okla., assignors to Phillips Petroleum Company, a corporation of Delaware

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5 Claims. (Cl. 255—35)

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This invention relates to power operated tongs of the type adapted to the screwing up and unscrewing of pipe or tubing especially tubing situated in an oil well.

The embodiment of the invention herein disclosed and as illustrated in the drawings is adapted to operation by means of pressure fluid but, as the description proceeds, it will become apparent that other forms or sources of mechanical power may be employed in the operation thereof as, for example, electric motors, internal combustion engines, and the like. It will also be clear that the power may be applied to the tongs through a flexible shaft from any suitable source.

An object of this invention is to provide power operated tongs specifically adapted for use on oil wells and for transportation in the field on a trailer or other suitable mobile unit.

An important advantage of the tool of this invention is that it is adaptable to presently used tubing spiders and elevators and through adaptation to presently used spiders the tubing is "backed up" during coupling and uncoupling.

More detailed advantages of this invention are present in the fact that by the use thereof one man in a tubing crew is eliminated, the need for pounding the collars and hence the elimination of damage thereto is removed, the tightness of the make up of threads is easily controlled and screwing up and unscrewing of the pipe sections is speeded up all with diminished fatigue of and increased safety for the crew.

Other more specific advantages of the invention is that it is readily adaptable for use in the field employing simple controls which can be made as sensitive as required. The structure is simple and relatively inexpensive and is of such a nature as to insure a rugged construction. Furthermore, its use eliminates the need of hanging or swinging the tong in the derrick.

Other and still more specific objects of the invention will be apparent from the following detailed description of a useful form thereof as illustrated in the attached drawings.

This invention resides substantially in the combination, construction, arrangement and relative location of parts, all as herein disclosed.

In the accompanying drawings,

Figure 1 is a top plan view of the structure of this invention;

Figure 2 is a cross-sectional view taken on the line 2—2 of Figure 1 with some parts removed for the sake of simplicity;

Figure 3 is a side elevational view of the structure showing its relationship to the spider and casing head when in use;

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Figure 4 is a detailed cross-sectional view taken on the line 4—4 of Figure 1;

Figure 5 is a cross-sectional view taken on the line 5—5 of Figure 4; and

Figure 6 is an enlarged detail elevational view of a modified support for the gripping devices.

In the tong of this invention as disclosed, a rotatable table 1 is provided with a downwardly extending central tubular supporting body 31 by means of which it is mounted in two pairs of roller thrust bearings 3 which lie between a radial flange 37 on the tubular portion 31 and a locking nut, collar, or other suitable locking device 4 engaging the extension 31 as shown. A plate 32 on the fixed head 2 lies between the pairs of anti-friction bearings, thereby providing a rotatable support for the table 1.

The head 2 is secured to a pair of standards 6, such as hydraulic pipes and the like, preferably of cylindrical cross-section, by means of welding or in any other suitable manner and with any other suitable construction.

The tubular supports 6 extend into a pair of tubes 7 the internal diameter of which is somewhat greater than the external diameter of the tubes 6. Attached to the telescoped ends of the tubes 6 in any suitable manner, as by shrinking thereon, are caps 11 which close the lower ends of the tubes 6 and form a tight sliding fit on the inside of the tubes 7 which tubes comprise the cylinders of pressure fluid motors by means of which the table and associated parts are raised and lowered. The tubes 7 are mounted in and attached to, a supporting plate, or adaptor ring 8 which, when the tong is in use, sets down over the spider 9 which in turn sets on the casing head 10. The entire assembly is held in place by any suitable means such as bolts, screw jacks, or the like, not shown, by means of which it is securely fastened to the spider 9. The cylinders 7 are provided with pressure fluid pipe connections 33 by means of which pressure fluid may be supplied thereto and exhausted therefrom by means of valves all in a manner obvious to those skilled in the hydraulic art.

Pivotally mounted on brackets 34 attached to the top of table 1 in diametrically opposed relation are a pair of pipe gripping devices each of which includes a cylinder 16. The cylinders 16 are pivotally mounted by means of the pivot pins 15 in the brackets 34 and, as is clear from Figure 2, the center line of the pivot pins 15 is above the center line of the cylinder 16 so that the outer

or free ends of the cylinders tend to fall downwardly into the position shown in the figures. Within each cylinder is a piston which is normally urged into retracted position, as shown in Figure 4, by means of a spring 36. Pivotally mounted on a horizontal pivot pin 35 on the projecting end of each piston rod is the jaw or gripping die 14 being horizontally curved to form a concave face of a radius substantially the same as that of the pipe to be operated upon. Each cylinder 16 is provided with a lateral arm 41 against which one end of a spring 40 may be abutted, which spring is seated at its other end in a recess in the table 1. This structure is clear from Figures 1 and 5.

The outer peripheral edge of the flange 37 (see Figure 2) has a semicircular groove cooperating with a similar groove on the inner face of a stationary ring 21 which fits over the flange 37 to provide an annular pressure fluid passage, as is clear from Figure 2. In the interest of simplicity in the drawing no details of the method of forming a fluid seal between the flange 37 and the ring 21 is shown. However, as those skilled in the art will appreciate, suitable forms of fluid seals may be employed to prevent leakage between them. Likewise no means has been shown for supporting the fixed ring 21 since this may be done in a number of obvious ways and addition thereof to the drawing would unnecessarily confuse it.

A pressure fluid feed pipe 38 is connected to the ring 21 and communicates with the annular passage formed between it and the flange 37, as shown in Figure 2. Formed in the rotary table 1 is a pressure fluid passage 39 establishing communication between the annular passage and the cylinders 16. This passage 39 passes through one of the pivot pins 15, as will be seen from Figure 2.

Mounted on the head 2 and supports 6 in any suitable manner, as by means of brackets, as shown in Figure 1, are the pressure fluid motors 17 having the supply and exhaust connections 17' in which will be included suitable control valves, not shown. These motors are connected through suitable gear reducing trains 18 to the bevel pinions 19 (see Figure 2) which mesh with a bevel ring gear 20 secured to the under face of the rotatable table 1.

A cover or cap 5 having a central opening encloses the lower bearing 3 and nut 4.

These parts are all secured together as a rigid unit which may be easily swung into and out of place of use as required.

In use, for example, in pulling tubing the starting nipple is screwed on, the tubing string picked up, and the spider 9 set on the casing head 10. The weight of the tubing string is then set on the spider 9 and the starting nipple is broken out with a hand tong. All of these operations are accomplished in the conventional manner and both conventional elevators and spider are used. The power tong of this invention is then picked up off of its trailer or other mobile unit and set down over the spider 9 which projects through a suitable opening in the adaptor ring 8 which, as previously stated, is securely fastened to the spider 9 by bolts or jack screws, not shown. The slips on the spider 9 are preferably serrated so that they grip the tubing and "back it up" or keep it from rotating while simultaneously supporting it during the operation of the power tong. Thus the spider 9 acts as a back-up for the tong in an obvious manner.

Pressure fluid is then supplied to the cylinders 7 to raise the tubes 6 and attached parts into a

position so that the gripping devices lie above the tubing coupling. While the parts remain in this position, pressure fluid is supplied by means of a control valve (not shown) in the pipe 38 to the cylinders 16. Pressure fluid flows through pipe 38, annular passage between the members 37 and 21, and passages 39 into the cylinders 16. This forces the pistons of the gripping devices radially inwardly of the tubing so that the gripping dies 14 firmly grasp the pipe at diametrically opposite sides. Pressure fluid is then supplied to the motors 17 by the manipulation of control valves (not shown) in the pipes 17', to cause the table 1 to revolve through the coaction of bevel gears 19 and ring gear 20. Thus the withdrawn length of the tubing is unscrewed as the remainder is held against rotation by the backing up action of the spider 9. When the tubing is broken the gripping devices are released by exhausting pressure fluid from the cylinders 16 at which time, of course, motors 17 are at rest. The detached tubing length is lifted away and while the elevators are being lowered to pick up the next stand of tubing the rotary table 1 and stationary head 2 are lowered below the tubing collar by bleeding off fluid from the cylinders 7. This provides the necessary clearance for latching the conventional elevators on under the tubing collar to withdraw the next tubing stand. While this stand is being pulled the rotary table 1 and stationary head 2 are again raised into position for gripping the next stand to again break the tubing as previously described.

The power tong herein disclosed can, as will be appreciated, be used with equal facility for running in tubing in which case the operations will be reversed and the rotation of the pressure fluid motors 17 reversed by reversing the fluid flow through them.

In view of the manner of supporting the cylinders of the gripping devices on the table, it will be seen that as a tubing stand is unscrewed the gripper ends of the gripping devices may move vertically by the pivoting of the cylinders 16 on the pivot pins 15, thus accommodating the device to the lengthening effect resulting from the unscrewing of the stand from the main portion of the tubing. To take care of side thrusts on the gripping devices, fixed guides 22 are mounted on the table 1, as shown, between which the gripping devices have freedom of vertical movement. In the reverse operation of running in tubing the cylinders 16 will be held in elevated position by the short springs 40 which can be readily inserted before starting in the hole with the tubing while the gripping pressure is being applied thereto so that as a stand is screwed into the main tube section the cylinders 16 may pivot downwardly towards the table as required by the relative telescoping of the tubing and coupling.

A modified support for the gripping devices is illustrated in Figure 6. In this case the brackets 34', corresponding to the brackets 34, are provided with elongated slots 34a in which the pivot pins or bosses 15 on the sides of the cylinders 16 may slide. In this case the connection between the passages 39 and the passages through the pivot pins 15 are connected preferably by flexible tubing so that when pulling the oil string the gripping devices 16 may ride upwardly with the pipe sections a sufficient distance to allow for the movement resulting from the unthreading of one section from another. This distance is roughly about three inches, and in this construction is taken care of by vertical movement of the grip-

ping devices as distinguished from the pivotal movement thereof in the previously described construction. In the case of running in oil strings, the cylinders 16 may be raised by hand to grip the pipe so that they may move downwardly as the sections are screwed up, or springs like the springs 40 can be positioned to hold the gripping devices in raised position to be depressed against the reaction of the springs as the sections are screwed up.

From the above description it will be apparent that the structure of this device is capable of considerable variation without departure from the scope of the novel subject matter thereof, and we prefer, therefore, not to be limited to the specific embodiment employed for the purpose of illustrating the invention, but rather by the claims granted us.

What is claimed is:

1. A power tong as described comprising a relatively stationary support, means for mounting said support on the tubing spider of an oil well casing head, a rotatable table mounted on said support, said table having a central opening through which the tubing may pass, power driven gear means for effecting rotation of said table, a pair of pressure fluid operated clamping devices mounted on said table and diametrically disposed on opposite sides of said table opening, and pressure fluid supply connections for said clamping devices comprising a ring member supported concentrically of said table, and a disc member connected to said table for rotation therewith and in fluid tight relation, said ring member and disc member having cooperating grooves forming a pressure fluid passage, a pressure fluid connection from said passage to said clamping devices, and a pressure fluid connection to said ring member whereby pressure fluid may be supplied to said clamping devices while the table is in motion.

2. In the combination of claim 1, said clamping devices each comprising a pressure fluid cylinder, a piston reciprocably mounted in said cylinder and a clamping jaw secured to said piston, and means for pivotally mounting each cylinder on said table near the end of the cylinder remote from the end adjacent the clamping jaw.

3. In the combination of claim 1, said clamping devices each comprising a pressure fluid cylinder, a piston reciprocably mounted in said cylinder and a clamping jaw secured to said piston, means for pivotally mounting each cylinder on said table near the end of the cylinder remote from the end adjacent the clamping jaw, and spring means for normally urging said cylinders about their pivotal support away from the plane of said table.

4. In the combination of claim 1, resilient means acting on said pistons to move them in a direction to separate said clamping jaws.

5. A power tong as described comprising a relatively stationary support, means for mounting said support on the tubing spider of an oil well casing head, a table rotatably mounted on said support having a central tubing passage therein, pressure fluid operated gripping devices mounted on said table adjacent said opening, power driven means connected to said table for effecting rotation thereof, pressure fluid supply means for said clamping devices comprising a first member fixed with respect to said table and a second member secured to said table for rotation therewith and contacting said first member in fluid tight relation, said two members being complementarily grooved to form a pressure fluid passage, and a pressure fluid pipe connection to said first member communicating with said passage.

JESSE S. MONTGOMERY.
HAROLD S. KELLY.

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